metrical reasoning, that the common tangent planes of the spinode developе and the node-couple develope are stationary planes of the one or the other of the two developes, that is, $i' = 0$, and the reasoning seems correct as far as it goes, but it was not shown how the demonstration would (as it ought to do) fail in the case of a surface having a double or cuspidal curve. I showed also that in the case where the common tangent plane is a stationary plane of the spinode develope (that is for the planes β'), the spinode curve and the node-couple curve touch instead of simply intersecting, it would seem that the tangent plane at such point is to be counted once, and not twice, in reckoning the number β' of such tangent planes; the like remark applies, of course, also to the points of intersection β of the double and cuspidal curves.

The Rev. Dr. Lloyd read a paper—

ON THE EFFECT OF A DISTANT LUMINARY, SUPPOSED MAGNETIC, UPON THE DIURNAL MOVEMENTS OF THE MAGNETIC-NEEDLE.

It has been usual to ascribe the ordinary diurnal variations of the magnetic needle to the influence of solar heat, either operating directly upon the magnetism of the earth, or generating thermo-electric currents in its crust. The credit of these hypotheses has been of late somewhat weakened by the discovery of a *lunar* diurnal variation in the three magnetic elements; while, at the same time, new laws of the *solar* diurnal change have been established, which are thought to be incompatible with the supposition of a thermic agency. There has been, accordingly, a tendency of late to recur to the hypothesis that the sun and moon are endued with magnetism, whether inherent or induced; and it is, therefore, of importance to investigate the effects which bodies, so constituted, would produce on a needle at the earth's surface, and to compare them with those observed. In the present communication the author has endeavoured to solve this question, on the supposition that the assumed magnetism of these luminaries is original and permanent. The results prove the insufficiency of the hypothesis to explain the phenomena.

We shall suppose, for simplicity, that the centre of the acting magnet is in the plane of the equator. So far as the diurnal change is concerned, we may suppose it to be fixed; accordingly, we may take that centre as the origin of co-ordinates, the line connecting it with the centre of the earth as the axis of x, and the plane of the equator as the plane of (xy). Then, if (x, y, z) be any point of the fixed magnet, μ the quantity of free magnetism contained in the element ds of the magnet at that point, m a magnetic element on the earth's surface, and (a, b, c) its co-ordinates, the force exerted by μ on m is

$$\frac{m\mu ds}{\rho^2};$$

in which ρ denotes the mutual distance of the points (a, b, c) and

(x, y, z). And the components of the total force exerted by the magnet on the magnetic element are

$$m\int\frac{(a-x)\mu ds}{\rho^3}, \qquad m\int\frac{(b-y)\mu ds}{\rho^3}, \qquad m\int\frac{(c-z)\mu ds}{\rho^3}.$$

The earth's radius and that of the luminary being small in comparison with their distance, the foregoing expressions are found to be reducible to

$$\frac{2mM\cos\alpha}{D^3}, \qquad \frac{-mM\cos\beta}{D^3}, \qquad \frac{-mM\cos\gamma}{D^3};$$

in which D denotes the distance of the centre of the magnet from the centre of the earth, and α, β, γ the angles which its axis makes with the three axes of co-ordinates, and in which

$$M=\int\mu s ds,$$

the integral being taken between the limits $s=\pm l$, l being half the length of the acting magnet.

Now, in place of a single magnet, let there be an indefinite number, distributed in any manner throughout the acting magnetic body. Then, the radius of this body being small in comparison with its distance, the variations of D, both in magnitude and direction, may be neglected, and we have, for the three components of the acting forces,

$$X=\frac{2mP}{D^3}, \qquad Y=\frac{-mQ}{D^3}, \qquad Z=\frac{-mR}{D^3};$$

in which

$$P=\Sigma(M\cos\alpha), \qquad Q=\Sigma(M\cos\beta), \qquad R=\Sigma(M\cos\gamma).$$

In order to determine the effects of these forces upon a freely suspended horizontal magnet, they must be resolved into three others,—two of them in the plane which touches the earth at the point m (one in the meridian, and the other perpendicular to it), and the third in the direction of the earth's radius. The moment of the two former to turn the needle is equal to the moment of the earth's force by which it is opposed, or by $mU\Delta\delta \sin 1'$, in which U is the horizontal component of the earth's force, and δ the magnetic declination. We thus obtain an expression of the form,

$$\Delta\delta=\frac{1}{D^3U}(A+B\sin\theta+C\cos\theta);$$

in which A, B, and C are known functions of P, Q, R, and of the latitude and magnetic declination at the place of observation. Similar results are found for the changes of the two components of the terrestrial magnetic force.

From these results we learn that—

1. The effect of a distant magnetic body consists of two parts, one of which is *constant* throughout the day, while the other varies with the *hour-angle* of the luminary.

2. Each of these parts varies *inversely as the cube of the distance* of the luminary.

3. The variable part will give rise to a *diurnal inequality*, having one maximum and one minimum in the day, and subject to the condition—

$$\Delta_\theta + \Delta_{\pi+\theta} = 0.$$

This law does not hold with respect either to the solar or to the lunar diurnal variation.

Thus, in the solar diurnal variation of the declination, the changes of position of the magnet throughout the night are comparatively small, and do not correspond (as required by the foregoing law) to those which take place at the *homonymous* hours of the day. The phenomena of the lunar diurnal variation are even more opposed to the deduced law, the variation having *two maxima* and *two minima*, of nearly equal magnitude, in the twenty-four lunar hours, and its values at homonymous hours having, for the most part, the *same sign*. Hence the phenomena of the diurnal variation are not caused by the direct magnetic action of the sun and moon.

Mr. Henry Conybeare communicated a short notice of the works recently erected for the purpose of supplying the city of Bombay with water.

It was stated by Dr. Stokes that Mr. Groux, a gentleman having congenital fissure of the sternum, was at present in Dublin, and that the Academy would confer a great benefit on medical and anatomical science if they would appoint a commission to inquire into his case. It was then resolved that the Council be requested to consider the propriety of appointing a commission to examine and report on the case of Mr. Groux.

The Secretary announced the presentation by her Majesty's Government of a collection of 514 volumes of Statutes, Journals of the Houses of Parliament, London Gazettes, and Newspapers, as a donation to the Library of the Academy.

Resolved,—That the thanks of the Academy be presented to Colonel Larcom, by whom this large donation to the Library has been made to the Academy.